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OCT 23 2003

TC 1700

PATENT



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No. : 09/586,628 Confirmation No.: 7768
Applicant : Benjamin Chu *et al.*
Filed : June 5, 2000
TC/A.U. : 1713
Title: : "Polymer Solution for Separation
of Charged Macromolecules by Electrophoresis"
Examiner : K. EGWIM
Docket No. : 178-289
Date : October 16, 2003

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DECLARATION UNDER 37 CFR 1.132

I, Dr. Benjamin Chu, state the following:

1. I am one of the inventors for the above-referenced patent application.
2. My curriculum vitae is attached.
3. The present invention includes polymer solutions that are useful as separation media for electrophoresis, in particular, capillary electrophoresis. These polymer solutions comprise a plurality of different polymers in the form of interpenetrating networks (IPNs).
4. The IPNs of the present invention comprise at least two independent polymer networks that are intermeshed within each other. That is, at least two independent polymer

networks are created, penetrate one another, but are not covalently bonded to one another. The IPNs of the present invention do not phase separate during electrophoretic separations.

5. The IPNs of the present invention **cannot** be prepared by simply dissolving one polymer into another. Instead, for example, a first polymer is formed into a matrix; then, another polymer is polymerized within the matrix.

6. The IPNs of the present invention have specific structural properties. For example, IPNs, formed from a first and second polymer, have a lower weight to volume ratio than the combined weight to volume ratios of the first polymer and the second polymer. Also, *each polymer in the IPN has an overlap concentration that is greater than its own overlap concentration.* This is the essence of the present IPN, i.e., the polymer network consists of two (or more) polymers that can tolerate a small amount of incompatibility so that they dislike each other sufficiently to avoid entanglements of one type of polymer chains with another, but not so much as to phase separate. When each polymer has its concentration above its own overlap concentration, a transient polymer network of that polymer is formed. When both are above the overlap concentrations, they then form the IPN. An IPN does not exist if one of the polymers is at a dilute concentration. The DNA chains passing through the polymer network feels the surroundings on a molecular scale. Simple mixing of two polymers at concentrations above the overlap concentration would not provide IPNs.

7. Dubrow (U.S. Patent No. 5,164,055) does **not** disclose interpenetrating networks of polymers. Instead, Dubrow describes his matrix as a **mixture** of a first polymer and a second polymer.

8. Madabhushi et al. (U.S. Patent No. 5,567,292) disclose media for separating biomolecules that include a polymeric "sieving component" and a polymeric "surface interaction component." These media are formed by **mixing** the two components together. Accordingly,

Madabhushi et al. do **not** disclose interpenetrating networks.

9. Hooper et al. (U.S. Patent No. 5,885,432) disclose an electrophoretic medium that changes its viscosity in response to temperature changes. In order to effect these viscosity changes, this medium includes un-crosslinked high molecular weight polymers. Hooper et al. teach a "mixture." Accordingly, Hooper et al. do **not** disclose interpenetrating networks.

10. Polymer mixtures are different structurally and functionally from the IPNs of the present invention, as discussed in Item 6. A first and second polymer in the IPN form would provide superior separation results vis-à-vis the same first and second polymer in the form of a mixture.

11. I hereby declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true. Further that these statements were made with the knowledge that willfully false statements, and the like, so made are punishable by fine or imprisonment or both under Section 1001 of Title 18 of the United States Code, and that such willfully false statements may jeopardize the validity of the application of any patent issued thereon.



Dr. Benjamin Chu